

We claim:

1. A process for continuously preparing a compound which bears at least two functional groups which are each independently selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group, comprising the steps of
 - a) adding two terminal olefins which bear the functional groups required to prepare the compound as per a1) containing at least two functional groups, in the presence of a compound as per a3) which is suitable as a catalyst for this addition and is homogeneous with respect to the reaction mixture to obtain a mixture comprising
 - a1) a compound which is obtained by monoaddition of the two terminal olefins mentioned and bears at least two functional groups which are each independently selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group,
 - a2) a compound which is obtained by polyaddition of the two terminal olefins mentioned and
 - a3) the compound which is suitable as a catalyst for this addition and is homogeneous with respect to the reaction mixture,
 - b) distilling the mixture obtained in step a) to obtain
 - b1) the compound which is obtained by monoaddition of the two terminal olefins mentioned and bears at least two functional groups which are each independently selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group, as the top product and
 - b2) a mixture comprising
 - b2a) a compound which is obtained by monoaddition of the two terminal olefins mentioned and bears at least two functional groups which are each independently selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group,
 - b2b) a compound which is obtained by polyaddition of the two terminal olefins mentioned and
 - b2c) the compound which is suitable as a catalyst for this addition and is homogeneous with respect to the reaction mixture,

- 5 c) separating the entire mixture obtained in step b2) or a portion thereof by means of a semipermeable membrane to obtain a permeate and a retentate, in such a way that the weight ratio of component b2b) to component b2c) in the mixture b2) fed in step c) is smaller than in the retentate,
- 10 d) recycling the permeate obtained in step c) partly or fully into step a)
- and
- e) recycling the portion of the mixture obtained in step b2) which has not been separated in c) partly or fully into step a).
- 15 2. A process as claimed in claim 1, wherein the compound as per a1) in the mixture obtained in step a) is hydrogenated between steps a) and b) to obtain a saturated compound.
- 20 3. A process as claimed in either of claims 1 and 2, wherein the terminal olefins used are two olefins which each independently have the formula $H_2C=CHR^1$ in which R^1 is a nitrile group, carboxylic acid group, carboxylic ester group or carboxamide group.
- 25 4. A process as claimed in any of claims 1 to 3, wherein the addition in step a) is carried out in the presence of a compound, as a catalyst, which is homogeneous with respect to the reaction mixture and contains rhodium, ruthenium, palladium or nickel.
- 30 5. A process as claimed in any of claims 1 to 3, wherein the addition in step a) is carried out in the presence of a compound, as a catalyst, which is homogeneous with respect to the reaction mixture and contains rhodium.
- 35 6. A process as claimed in any of claims 2 to 5, wherein the hydrogenation between steps a) and b) is carried out in the presence of a compound, as a catalyst, which is homogeneous with respect to the reaction mixture and contains rhodium, ruthenium, palladium or nickel.

7. A process as claimed in any of claims 2 to 5, wherein the hydrogenation between steps a) and b) is carried out in the presence of a compound, as a catalyst, which is homogeneous with respect to the reaction mixture and contains rhodium.
- 5 8. A process as claimed in any of claims 2 to 7, wherein the same compound is used as a catalyst in the addition in step a) and the hydrogenation between steps a) and b).
- 10 9. A process as claimed in any of claims 1 to 8, wherein the addition in step a) or the hydrogenation or both are carried out in the presence of a compound, as a catalyst, which is homogeneous with respect to the reaction mixture, contains rhodium and has the formula $[L^1RhL^2L^3R]^+X^-$ where
- 15 L^1 is an anionic pentahapto ligand;
 L^2 is an uncharged 2-electron donor;
 L^3 is an uncharged 2-electron donor;
 R is selected from the group consisting of H, C_1 - C_{10} -alkyl, C_6 - C_{10} -aryl and C_7 - C_{10} -aralkyl ligands
 X^- is a noncoordinating anion;
- 20 and where two or three of L^2 , L^3 and R are optionally joined.
10. A process as claimed in claim 9, wherein L^1 is pentamethylcyclopentadienyl.
- 25 11. A process as claimed in either of claims 9 and 10, wherein X^- is selected from the group consisting of BF_4^- , $B(\text{perfluorophenyl})_4^-$, $B(3,5\text{-bis(trifluoromethyl)phenyl})_4^-$, $Al(OR^F)_4^-$ where R^F is identical or different part-fluorinated or perfluorinated aliphatic or aromatic radicals.
- 30 12. A process as claimed in any of claims 9 to 11, wherein L^2 and L^3 are each independently selected from the group consisting of C_2H_4 , $CH_2=CHCO_2Me$, $P(OMe)_3$ and $MeO_2C-(C_4H_6)-CO_2Me$.
- 35 13. A process as claimed in any of claims 9 to 11, wherein L^2 and L^3 together are selected from the group consisting of acrylonitrile and 5-cyanopentenoic ester.

14. A process as claimed in any of claims 9 to 12, wherein L^2 and R together are $-\text{CH}_2-\text{CH}_2\text{CO}_2\text{Me}$.
15. A process as claimed in any of claims 9 to 12 or 14, wherein L^2 , L^3 and R together are $\text{MeO}_2\text{C}(\text{CH}_2)_2-(\text{CH})-(\text{CH}_2)\text{CO}_2\text{Me}$.
16. A process as claimed in claim 9, wherein the addition in step a) or the hydrogenation or both are carried out in the presence of a compound, as a catalyst, which is homogeneous with respect to the reaction mixture, contains rhodium and is selected from the group consisting of
- [$\text{Cp}^*\text{Rh}(\text{C}_2\text{H}_4)_2\text{H}]^+ \text{BF}_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{P}(\text{OMe})_3)(\text{CH}_2=\text{CHCO}_2\text{Me})(\text{Me})]^+ \text{BF}_4^-$,
 [$\text{Cp}^*\text{Rh}(-\text{CH}_2-\text{CH}_2\text{CO}_2\text{Me})(\text{P}(\text{OMe})_3)]^+ \text{BF}_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{MeO}_2\text{C}(\text{CH}_2)_2-(\text{CH})-(\text{CH}_2)\text{CO}_2\text{Me})]^+ \text{BF}_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{C}_2\text{H}_4)_2\text{H}]^+ \text{B}(3,5\text{-bis(trifluoromethyl)phenyl})_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{P}(\text{OMe})_3)(\text{CH}_2=\text{CHCO}_2\text{Me})(\text{Me})]^+ \text{B}(3,5\text{-bis(trifluoromethyl)phenyl})_4^-$,
 [$\text{Cp}^*\text{Rh}(-\text{CH}_2-\text{CH}_2\text{CO}_2\text{Me})(\text{P}(\text{OMe})_3)]^+ \text{B}(3,5\text{-bis(trifluoromethyl)phenyl})_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{MeO}_2\text{C}(\text{CH}_2)_2-(\text{CH})-(\text{CH}_2)\text{CO}_2\text{Me})]^+ \text{B}(3,5\text{-bis(trifluoromethyl)phenyl})_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{C}_2\text{H}_4)_2\text{H}]^+ \text{B}(\text{perfluorophenyl})_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{P}(\text{OMe})_3)(\text{CH}_2=\text{CHCO}_2\text{Me})(\text{Me})]^+ \text{B}(\text{perfluorophenyl})_4^-$,
 [$\text{Cp}^*\text{Rh}(-\text{CH}_2-\text{CH}_2\text{CO}_2\text{Me})(\text{P}(\text{OMe})_3)]^+ \text{B}(\text{perfluorophenyl})_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{MeO}_2\text{C}(\text{CH}_2)_2-(\text{CH})-(\text{CH}_2)\text{CO}_2\text{Me})]^+ \text{B}(\text{perfluorophenyl})_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{C}_2\text{H}_4)_2\text{H}]^+ \text{Al}(\text{OR}^F)_4^-$,
 [$\text{Cp}^*\text{Rh}(\text{P}(\text{OMe})_3)(\text{CH}_2=\text{CHCO}_2\text{Me})(\text{Me})]^+ \text{Al}(\text{OR}^F)_4^-$,
 [$\text{Cp}^*\text{Rh}(-\text{CH}_2-\text{CH}_2\text{CO}_2\text{Me})(\text{P}(\text{OMe})_3)]^+ \text{Al}(\text{OR}^F)_4^-$ and
 [$\text{Cp}^*\text{Rh}(\text{MeO}_2\text{C}(\text{CH}_2)_2-(\text{CH})-(\text{CH}_2)\text{CO}_2\text{Me})]^+ \text{Al}(\text{OR}^F)_4^-$,
- where R^F is identical or different part-fluorinated or perfluorinated aliphatic or aromatic radicals.
17. A process as claimed in any of claims 1 to 16, wherein the hydrogenation is carried out at a partial hydrogen pressure in the range from 10 to 20 000 kPa.
18. A process as claimed in any of claims 1 to 17, wherein the hydrogenation is at an average mean residence time of the monoolefinically unsaturated compound which bears at least two functional groups which are each independently

selected from the group consisting of nitrile group, carboxylic acid group, carboxylic ester group and carboxamide group in the range from 0.1 to 100 hours.

- 5 19. A process as claimed in any of claims 2 to 18, wherein the mixture obtained in the addition in step a) is fed to a hydrogenation as claimed in any of claims 1 to 18 without removing the rhodium-containing compound used as a catalyst.
- 10 20. A process as claimed in any of claims 1 to 19, wherein the distillation in step b) is carried out at a temperature in the range from 50 to 200°C.
21. A process as claimed in any of claims 1 to 20, wherein the distillation in step b) is carried out at an average mean residence time in the range from 1 to 45 minutes.
- 15 22. A process as claimed in any of claims 1 to 21, wherein the distillation in step b) is carried out at a pressure in the range from 0.5 to 500 mbar.
- 20 23. A process as claimed in any of claims 1 to 22, wherein a membrane which comprises substantially one or more organic or inorganic materials.
24. A process as claimed in any of claims 1 to 23, wherein the mean average pore size of the membrane is in the range from 0.9 to 50 nm in the case of inorganic membranes.
- 25 25. A process as claimed in any of claims 1 to 23, wherein the mean average separation limit of the membrane is in the range from 500 to 100 000 daltons in the case of organic membranes.
- 30 26. A process as claimed in any of claims 1 to 25, wherein the ratio of the pressure on the retentate side of the membrane to the pressure on the permeate side of the membrane is in the range from 2 to 100.
27. A process as claimed in any of claims 1 to 26, wherein a pressure in the range from 0.1 to 10 MPa is applied on the retentate side of the membrane.
- 35 28. A process as claimed in any of claims 1 to 27, wherein a pressure in the range from 1 to 1 000 kPa is applied on the permeate side of the membrane.

29. A process as claimed in any of claims 1 to 28, wherein the membrane separation is carried out at a temperature in the range from 0 to 150°C.
- 5 30. A process as claimed in any of claims 1 to 29, wherein the component obtained as b1) in step b) is hydrogenated to obtain a saturated compound.